IEAGHG Information Paper 2017-IP53; 13 Years of Research on CO_2 Storage at the Ketzin Pilot Site Comes to a Close

The test injection site at Ketzin, 40 km west of Berlin, was the first European on-shore CO_2 storage project. The project, which started in 2004, held its final meeting of project partners and contributors on 13th September 2017. This project, coordinated by the German Research Centre for Geosciences (Deutsches GeoForschungsZentrum GFZ), has made important advances in the scientific understanding of CO_2 geological storage and demonstrated how good community relations can be built.

The site was selected partly because it was a former natural gas storage site which meant that the subsurface structure and geology had been previously studied since the 1960s. The target reservoir is a fluvial sandstone capped by 200m of impermeable mudstone and anhydrite. The Late Triassic sandstone of the Stuttgart Formation occurs at a depth of 630m and forms an anticlinal (dome shape) making it an ideal reservoir for trapping gas. The fluvial system forms a series of channels bounded by less permeable flood plain sediments which has presented some technical challenges. Geologists engaged in the project have built a model of reservoir by analysing cores retrieved from the target formation. The geological information gained from this material has been combined with geophysical surveys and borehole logs to construct the model. However geological models can only provide a simulation based on limited data and are not an exact replication. The channel system means that there is a high degree of heterogeneity so when CO_2 is injected the plume shape, as detected by geophysical monitoring, does not always match the predicted migration. Initially a good fit was observed at Ketzin, and the predicted reservoir pressure matched the down-hole measurements. As injection progressed the modelled simulation of the plume deviated from its observed distribution. However, by comparing the actual position with the predicted outline it was possible to modify and improve the model – a techniques applied at other test sites. In this respect Ketzin has provided valuable experience and made a significant contribution to improving the understanding of how CO_2 behaves in a reservoir.

The long-term fate of the trapped CO_2 has also been modelled at Ketzin to predict what changes might occur after ~2,000 years. Although there will be some mineral dissolution and carbonate mineralisation caused by the presence of the CO_2 most will remain in solution. Repeated seismic surveys can be compared to evaluate what changes may have occurred in a reservoir. At Ketzin this time-lapse technique has been used to estimate the mass of CO_2 present in the reservoir which has provided additional evidence of the amount of CO_2 that has dissolved since injection began.

The Ketzin project has shown that in addition to the scientific advances that have been made there has also been an exemplary approach to public relations. A four part plan has implemented right from the start of the project both to engage with the local community and inform them of progress. Firstly, a visitor centre was established with frequent tours for different parties from the local community. Secondly, informative material was produced for different audiences which was supplemented by exhibits on different aspects of the project. Over 3,000 visitors from all over the world have attended the site. High level events such as the start of injection attracted notable media interest including TV reports. At a local level members of the team visited local schools and organised events including the ”long night of the science” which included simple interactive hands-on exhibits that helped to explain the concepts related to the underground storage of CO_2. Public engagement has also included an annual open house day which included a tug-of-war between the local volunteer fire brigade and members of the project team. Alas the fire fighters always won! Now that the project is about to close a virtual tour comprised of a series of interlinked short films has been produced so that the knowledge of the Ketzin test site, and the contribution it has made to the global CO_2 storage challenge, is not lost to a broader audience.

The experience gained at Ketzin has been invaluable. As a successful European project Ketzin has included 18 collaborative programmes which have supported a broad range of scientific research. The legacy of this work is that has helped to develop expertise in tracking CO_2 in a complex reservoir and using the plume observations to refine predictive simulations. Ketzin is one of 45 small-scale sites world-wide where less than 100,000 metric tonnes of CO_2 has been injected. Comparison of monitoring, modelling and even public outreach experience from different sites will invariably build confidence in long-term and much larger scale CO_2 storage.

IEAGHG has been involved with this project from its inception. Tim Dixon served on the original advisory committee helping to guide the research programme. The Ketzin project has generated a significant quantity of high quality research papers which have been presented at numerous IEAGHG monitoring and modelling network meetings. James Craig, the IEAGHG's senior geologist, gave one of a series of keynote presentations at the final meeting on the theme of Ketzin's contribution to CCS world-wide.

James Craig
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